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DIFFERENTIAL PERSONALITY DEVELOPMENT IN YOUNG ADULTS AS RELATED TO ABILITY.

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THE DATA FROM PREVIOUS STUDIES WERE USED TO DETERMINE IF THERE WERE DIFFERENTIAL NONINTELLECTUAL (PERSONALITY) CHANGES IN YOUNG ADULTS WHO DIFFERED MARKEDLY IN MEASURED ACADEMIC APTITUDE. THREE OF THE FORMER STUDIES WERE FOR A 2-YEAR TEST AND RETEST TIME PERIOD, AND TWO WERE FOR A 4-YEAR TEST AND RETEST TIME PERIOD. COMPARISONS OF NONINTELLECTUAL CHANGES BETWEEN HIGH- AND LOW-APTITUDE GROUPS OF MALES AND OF FEMALES WERE CONDUCTED. THIS RESULTED IN 40 POSSIBLE COMPARISONS OF THE CHANGES OVER TIME FOR HIGH- VERSUS LOW-APTITUDE GROUPS. THE ETHNOCENTRISM SCALE, THE DOGMATISM SCALE, THE AUTHORITARIANISM SCALE, THE CALIFORNIA PSYCHOLOGICAL INVENTORY, AND THE STUDY OF VALUES WERE THE INSTRUMENTS USED TO OBTAIN THE SCORES FROM THE YOUNG ADULT SUBJECTS. THE MAJOR CONCLUSIONS DRAWN WERE THAT YOUNG ADULTS OF HIGH APTITUDE EXHIBITED MORE "PSYCHOLOGICALLY POSITIVE" NONINTELLECTUAL CHANGE OVER TIME, AND THE DEVELOPMENT IS SIMILAR IN TREND TO PERSONALITY CHANGES OF COLLEGE STUDENTS IN GENERAL. (RS)

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Contract S-042, 18 February, 1964 to 30 September, 1964

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INTRODUCTION

Brief Statement of the Problem

The objective of the studies described herein was to determine if there were differential non-intellectual changes over two years or four years for young adults who differed markedly in measured academic aptitude.

Background of the Problem

Contrary to the widely read and quoted conclusions of Jacob (1957), all reported studies of personality change in college students during college report that measurable changes occur. From the earliest studies (Corey, 1936, 1940; Kuhlen, 1941; Newcomb, 1943) to the last published reviews on the topic (Bloom & Webster, 1960; McCullers & Plant, in press; Webster, Freedman, & Heist, 1962), changes in attitude, interest, personality, and value test scores have been reported for college students during their college years. With respect to specific study variables (i.e., authoritarianism, dogmatism, and ethnocentrism), it has been consistently reported from institutions as divergent as Michigan State University (Lehmann & Dressel, 1962, 1963), San Jose State College (Plant, 1958a, 1958c, 1962), University of Santa Clara (Foster, Stanek, & Krassowski, 1961), Vassar College (Freedman, 1960; Webster, 1958; Webster, et. al., 1962), and six California junior colleges (Telford & Plant, 1963) that:

(a) freshman students have significantly higher

Authoritarianism, Dogmatism, or Ethnocentrism scale means than do upperclass or senior students, and

(b) freshman students have significantly higher Authoritarianism, Dogmatism, or Ethnocentrism scale means than they do as retested college juniors or seniors.

For those groups studied at San Jose State College, the changes took place irrespective of general education curriculum pursued (Plant, 1964), and irrespective of sorority or fraternity membership and non-membership (Plant, 1958b, in press).

The interpretation of these reported results has generally been that the college experience has been a "liberalizing" one in terms of personality development. Either implicitly or explicitly, the reported personality changes have been attributed to the college impact upon student personality.

There have been only four studies published to date on personality changes associated with college experience wherein control or comparison groups have been included in the research design. In these studies, groups of subjects with no college or with less than two years of college attendance in two years (Plant, 1958a, 1962; Telford & Plant, 1963) changed on the study variables in the same direction and usually to a similar extent as did subjects enrolled for two years in the two years of the studies. Groups of subjects with no college

attendance or with less than four years of college attendance in four years (Lehmann & Dressel, 1963; Plant, 1962) changed on the study variables in the same direction and usually to a similar extent as did subjects enrolled for four years in the four-year period of the studies.

These two- and four-year results have called the whole literature dealing with the effects of a collegiate experience upon student personality into question. It may very well be that what investigators have been reporting as changes in personality characteristics resulting from a collegiate experience are developmental changes in personality for bright young adults irrespective of their higher educational attainment. The current study is concerned with one aspect of this possibility.

Longitudinal investigations of the subsequent intellectual development of initially brighter-than-average subjects indicate that changes continue well into adulthood. Owens (1953) found that 127 college freshmen tested with the Army Alpha Test and again 31 years later with the same test had significantly higher means on the second test administration than on the first. Bayley and Oden (1955) obtained a similar result with a large sample of Terman's gifted subjects given the Terman Concept Mastery Test as young adults and again after 12 years. Bayley (1955, 1957) has also reported similar results derived from repeated Wechsler-Bellevue testing

of subjects in the Berkeley Growth Study. The current study attempted to determine if non-intellectual characteristics change over time for brighter-than-average subjects in the same fashion that intellectual characteristics have been reported to change.

The groups of subjects studied were presumed to be brighter than average in that all subjects satisfactorily completed high school, applied for admission to a college, were admitted to a college, and the majority attended college. Evidence relevant to support of the presumption has been reviewed and reported by Cronbach (1960, p. 172-174), and in local studies (Conry, 1963; Plant & Lynd, 1959; Plant & Richardson, 1958).

Summary

All investigators of personality changes in students during college report changes. Four separate studies report that college students of two or four years attendance, students with "some college" in two or four years, and subjects with no college in two or four years all change during the two or four years in the same direction and usually to a similar extent. Other investigators have found that intellectual development for subjects who were initially brighter than average extends well into adulthood. The groups of subjects from the four studies of college effects wherein control or comparison groups were included are presumed to be brighter-than-average groups.

The present report concerns a series of studies of the non-intellectual changes over two and four years for the brightest and dullest subjects in three studies conducted locally. The purpose was to determine whether the change in scores over time on personality variables occurred differentially for subjects of different levels of academic aptitude.

PROCEDURES

All data needed for the current studies were available from three separate longitudinal research projects dealing with "college impact," and wherein control or comparison groups were a part of the research design. There were five separate studies undertaken, three with a two-year time interval between testing and retesting with the non-intellectual measures, and two with a four-year interval between testing and retesting. A description of the samples, instruments used, and statistical analyses is found below for each of the five studies. Because statistically significant sex differences were found on the study variables, all analyses were made for males and females separately. In each of the five studies, all tested and retested subjects were grouped together in their appropriate sex group irrespective of higher educational attainment during the original study periods.

Samples Studied and Instruments Used

Study 1. Two-year interval between testing and retesting. Original source of data: Plant (1958a).

A group of 755 subjects (356 males and 399 females) was tested in 1953 with a 32-item California Ethnocentrism Scale (Adorno, Frenkel-Brunswik, Levinson, & Sanford, 1950) and the 1949 form of the American Council on Education, Psychological Examination (A.C.E.) as a part of a college pre-matriculation testing program. The subjects were retested in 1955 with the Ethnocentrism Scale.

Study 2. Two-year interval between testing and retesting. Original source of data: Plant (1962).

A group of 1,440 subjects (600 males and 840 females) was tested in 1958 with a 30-item California Ethnocentrism Scale (Adorno, et. al., 1950), the Dogmatism Scale (Rokeach, 1956, 1960), the Gough revision of the Authoritarianism Scale (Gough, 1951), and the 1949 form of the A.C.E. as a part of a college pre-matriculation testing program. The subjects were retested in 1960 with the Ethnocentrism, Dogmatism, and Authoritarianism Scales.

Study 3. Two-year interval between testing and retesting. Original source of data: Telford & Plant (1963).

A group of 1,678 subjects (926 males and 752 females) was tested in 1960 with the Dogmatism Scale (Rokeach, 1956, 1960), the Study of Values (Allport, Vernon, & Lindzey, 1960),

the Sociability, Self-Control, Achievement via Independence, Intellectual Efficiency, and Responsibility Scales from the California Psychological Inventory (Gough, 1957), and Form A of the School and College Ability Test (S.C.A.T.) as a part of a pre-matriculation testing program in six public junior colleges in California. The subjects were retested with the Dogmatism Scale, the Study of Values, and the five scales from the California Psychological Inventory in 1962.

Study 4. Four-year interval between testing and retesting. Original source of data: Plant (1958c).

A group of 271 subjects (137 males and 134 females) was tested in 1953 with a 32-item California Ethnocentrism Scale (Adorno, et. al., 1950), and the 1949 form of the A.C.E. as a part of a college pre-matriculation testing program. The subjects were retested in 1957 with the Ethnocentrism Scale after they had finished four years of college. This was a special study in which no attempt was made to retest original subjects who failed, for any reason, to finish the B.A. degree in the four-year period.

Study 5. Four-year interval between testing and retesting. Original source of data: Plant (1962).

A group of 1,032 subjects (448 males and 584 females) was tested in 1958 with a 30-item California Ethnocentrism Scale (Adorno, et. al., 1950), the Dogmatism Scale (Rokeach, 1956, 1960), the Gough revision of the Authoritarianism

Scale (Gough, 1951), and the 1949 form of the A.C.E. as a part of a college pre-matriculation testing program. The subjects were retested in 1962 with the Ethnocentrism, Dogmatism, and Authoritarianism Scales.

For purposes of convenience in reporting results, all scale names will be identified hereinafter by conventionally used designations. In studies 1, 2, 4, & 5, the Ethnocentrism Scale will be referred to as the E Scale. In studies 2, 3, & 5, the Dogmatism Scale as the D Scale, and in studies 2 & 5, the Authoritarianism Scale as the F Scale. In study 3, the scale designations are CPI for the California Psychological Inventory, and Sy, Sc, Ai, Ie, and Re for the Sociability, Self Control, Achievement via Independence, Intellectual Efficiency, and Responsibility scales of the CPI. In addition, the Study of Values is designated A-V-L with T, E, A, S, P, and R as designations for the Theoretical, Economic, Aesthetic, Social, Political, and Religious scales of the A-V-L in study 3.

All five studies collectively provided select non-intellectual test and retest data for 3,873 subjects over a two-year period of time, and for a total of 1,303 subjects over a four-year period of time. It was felt that five separate studies which differed somewhat in the personality variables utilized, in the types of subjects studied, and in the time periods studied would enhance the generality of findings regarding change in personality as related to ability.

Statistical Analyses Performed

Within each subgroup (male, female) in each of the five studies, those subjects were selected whose aptitude scores (A.C.E. or S.C.A.T.) were in the upper quarter or in the lower quarter of the distribution for the intact subgroup. The resulting subgroups will henceforth be referred to as "high-aptitude" and "low-aptitude" groups. These groups, so constituted, became the object of the present analyses.

To examine the possibility of differential change in non-intellectual score over the two- or four-year period as a function of level of aptitude, an analysis of covariance was performed. Initial scores on the personality variable were used to adjust final scores; the test of significance was therefore made on the adjusted means between the high- and low-aptitude groups. Summed across the five studies one finds 20 variables, and since the analysis was performed separately for male and female subjects, 40 such tests resulted.

It was recognized that in the data for the non-intellectual variables a scaling problem could exist. For example, previous study of the intact groups from which the present subjects were selected for study had shown that the mean scores on certain of the ideology scales were relatively low, and that the distributions showed strong evidence of positive skewness. The same study showed frequent existence

of a modest but significant degree of correlation between level of aptitude and scale score (e.g., D, E, and F score). In the present study the groups contrasted are those which are in the opposite extremes of the aptitude score distribution, and so it was anticipated that they might differ in level of performance on non-intellectual variables. On several grounds, including the evidence of skewed distributions, it was considered possible that a reduction of five points for a subject whose initial score was low might not be equivalent to the same reduction for a subject whose initial score was higher. If this were so, the effect of level of performance and the effect of the scale problem would be confounded in the results of the tests of significance between adjusted means.

In recognition of this problem, a supplementary non-parametric analysis was adopted which circumvented the possible scale problem. In each of the 40 comparisons between contrasted groups (high and low-aptitude), the observation was made as to whether the subject's initial score exceeded his final score or not. A chi-square test was then obtained between this dimension and that of membership in the particular aptitude group.

RESULTS

Statistical Description of the Subjects

The number of cases in the original groups from which the present subjects were selected, and data relative to

academic aptitude scores of these groups are presented in Table 1.

Table 1

Academic Aptitude Scores for Groups From Which Subjects Were Selected for Study

		Study Number				
		1	2	3*	4	5
Males						
	M	103.2	108.5	63.7	106.8	109.3
	SD	23.0	21.1	17.0	21.6	21.5
	N	356	600	926	137	448
Females						
	M	100.2	106.4	58.2	103.3	107.0
	SD	23.3	21.1	17.4	18.4	21.1
	N	399	840	752	134	584

*aptitude measure: S.C.A.T. total raw score. Other scores are A.C.E. (1949 ed.) total raw score.

In the high-and low-aptitude groups as constituted for the present study, the number of cases in each will approximate one quarter of those in Table 1. Occasionally the number is less since in the subsequent analysis it was discovered that for some variables in some studies, no retest score was available on one or more of the non-intellectual measures. In roughly half of the groups, no scores were missing. In

the remainder, from one to 15 scores were missing and these subjects were necessarily eliminated from the study.

Preliminary Considerations

The data describing performance on the non-intellectual variables for the high-and low-ability subgroups are presented in Table 2 (male subjects), and Table 3 (female subjects). Consideration of the entries in the columns M_x (mean of initial test score) and M_y (mean of final test score) yields several observations relative to procedural matters raised earlier. First, there are apparent differences between means on many variables for males and females. Therefore, the separate treatment of the two sexes appears sound. Second, there are apparent differences between means on many variables for high-and low-aptitude groups. This is therefore as expected in view of the previously discussed evidence relative to the correlation between aptitude and non-intellectual variables among subjects of the type used here. Third, it is apparent that there are often substantial differences between initial level of performance and that achieved two or four years later.

Whereas these several findings are pertinent to the design of the study, they are not the object of the present investigation. Consequently, no statistical evidence of these differences is offered here. The interested person is referred to earlier studies where these dimensions have been of direct interest.

Change in Non-intellectual Function as Related to Level of Aptitude: Covariance Analysis

Final means, when adjusted by analysis of covariance procedures for initial performance, appear in Table 2 and Table 3 under the column headed M_y adj. For convenience, the adjacent column, headed $\Delta_{cov.}$, shows the relationship between the level of the adjusted means and level of aptitude (+ indicates that the high-aptitude group had the higher adjusted mean).

The statistical tests for the covariance analysis appear in the columns headed F_S and F_M. These give the F ratios appropriate to testing homogeneity of slopes and homogeneity of adjusted means, respectively.

Since homogeneity of slope (of regression of final score on initial score) is a precondition to the test of significance between adjusted means, it deserves first attention. For male subjects in all studies, the F ratio shows significance at the 5% level for the A-V-L variable S. For females, the A-V-L variable T shows significance at the 5% level, and the F-Scale score in Study 5 does the same at the 1% level. It may be noted that the slope test approaches significance for the A-V-L variable T for males, A-V-L S does not approach significance in its only other appearance, and that in the three other appearances of the F-Scale variable in the tables, the F ratios are all modest. In view of the 40 opportunities in the two tables for significance to be discovered, and in

Table 2

COMPARISONS OF HIGH AND LOW APTITUDE GROUPS: MALES

STUDY No.	VARIABLE	GROUP	Mx	My	SDy	My adj.	Δcov.	F_s*	Fm*	P+	χ^2	Δx^2	N
1	E	Hi	85.5	77.4	22.2	79.9	-	1.11	1.61	.31	.89	-	89
		Lo	93.9	86.2	26.0	83.6				.39			89
	D	Hi	153.0	143.3	24.7	147.5	-	.71	.14	.33	.57	+	150
		Lo	166.8	152.7	26.1	148.5				.28			150
2	E	Hi	80.6	73.5	22.0	78.1	-	1.18	3.45	.28	2.96	-	150
		Lo	93.9	86.7	23.8	82.1				.38			149
	F	Hi	117.3	101.5	21.7	105.9	-	.02	9.73	.20	.31	-	150
		Lo	131.9	117.3	21.6	112.9				.23			149
3	CPI Sy	Hi	24.4	25.0	5.2	24.5	+	.23	.11	.58	2.76	-	231
		Lo	22.7	23.9	5.0	24.4				.66			229
	CPI Sc	Hi	25.6	26.8	7.6	26.8	-	2.18	.49	.59	.09	-	231
		Lo	25.7	27.2	8.2	27.2				.61			229
	CPI Ai	Hi	19.6	21.6	4.2	20.1	+	.12	20.09	.73	.07	-	231
		Lo	14.7	16.8	4.8	18.3				.75			229
	CPI Ie	Hi	36.1	39.5	5.3	37.9	+	.10	9.90	.69	2.60	-	231
		Lo	31.3	34.7	5.8	36.3				.76			229
	CPI Re	Hi	30.3	31.3	4.7	30.1	+	.23	5.05	.65	1.80	-	231
		Lo	26.6	28.2	4.8	29.3				.72			229
	AVL T	Hi	46.1	46.5	7.4	46.0	+	3.50	26.33	.56	5.18	+	231
		Lo	43.8	42.5	6.1	43.0				.44			229
	AVL E	Hi	40.3	39.8	8.7	40.2	-	.73	11.37	.50	2.14	-	228
		Lo	42.3	43.1	7.4	42.5				.57			216
	AVL A	Hi	36.6	38.9	10.1	38.3	+	1.93	13.18	.63	.42	+	228
		Lo	34.4	35.0	7.2	35.7				.60			216
	AVL S	Hi	34.6	35.5	7.1	35.9	-	4.63	4.71	.59	.00	0	228
		Lo	36.2	37.5	6.2	37.1				.59			216
	AVL P	Hi	42.8	42.5	7.2	42.6	-	.35	.95	.50	.95	-	228
		Lo	43.0	43.2	6.2	43.1				.55			216
	AVL R	Hi	38.3	36.6	10.6	36.8	-	.00	7.88	.42	3.85	-	228
		Lo	39.0	39.1	8.5	38.9				.52			216
	D	Hi	152.8	143.8	27.8	147.8	-	.73	19.89	.36	.06	-	228
		Lo	172.6	162.7	27.3	158.7				.38			224
4	E	Hi	78.6	64.7	17.5	69.1	-	.28	2.26	.26	.00	0	34
		Lo	98.0	80.6	22.9	76.1				.24			34
5	D	Hi	153.6	140.2	26.9	143.9	+	1.06	.31	.29	1.82	+	112
		Lo	165.9	146.0	24.7	142.2				.21			111
	E	Hi	80.7	69.2	23.6	73.8	-	.06	.95	.26	.04	-	112
		Lo	94.8	81.2	25.6	76.6				.28			111
	F	Hi	116.7	98.2	23.7	103.5	-	.20	.53	.21	1.82	+	112
		Lo	131.9	110.9	23.6	105.5				.14			110

*Values meeting the 5% significance level are underscored once; those meeting the 1% level are doubly underscored.

Table 3

COMPARISONS OF HIGH AND LOW APTITUDE GROUPS: FEMALES

STUDY No.	VARIABLE	GROUP	Mx	My	SDy	My adj.	Δcov.	Fs*	Fm*	p+	χ^2	Δx^2	N
1	E	Hi	76.7	69.0	22.7	75.5	-	.16	1.24	.29	.23	+	100
		Lo	99.3	85.5	26.1	79.0				.25			100
2	D	Hi	147.5	136.2	23.9	140.2	-	.03	.45	.29	.11	+	210
		Lo	161.5	145.8	28.3	141.7				.27			210
	E	Hi	69.3	62.7	17.4	68.9	-	.94	7.12	.32	.04	+	210
		Lo	90.3	79.6	22.7	73.4				.31			210
	F	Hi	111.2	97.9	21.7	103.6	-	2.82	2.21	.24	.05	+	210
		Lo	128.5	112.3	27.7	106.6				.23			210
3	CPI Sy	Hi	25.1	25.3	5.4	24.2	+	1.09	.29	.56	4.93	-	188
		Lo	21.9	22.8	5.6	23.9				.68			185
	CPI Sc	Hi	27.5	28.4	7.5	28.5	-	.83	2.30	.56	2.45	-	188
		Lo	28.1	29.6	8.3	29.5				.64			185
	CPI Ai	Hi	20.5	22.2	3.5	20.9	+	.07	29.08	.76	.00	0	188
		Lo	15.8	17.6	3.8	19.0				.76			185
	CPI Ie	Hi	38.6	40.6	4.9	39.0	+	.92	21.08	.72	.00	0	188
		Lo	32.7	35.0	5.9	36.6				.72			185
	CPI Re	Hi	32.5	33.0	4.0	32.1	+	2.95	2.82	.60	.39	-	188
		Lo	29.2	30.4	4.8	31.4				.64			185
	AVL T	Hi	39.3	40.2	7.4	40.1	+	5.60	8.83	.54	.44	+	186
		Lo	38.9	38.1	6.5	38.3				.50			173
	AVL E	Hi	36.7	35.8	7.5	36.4	-	.57	20.74	.52	1.15	-	186
		Lo	39.4	40.2	6.8	39.6				.58			173
	AVL A	Hi	41.5	43.5	9.6	42.1	+	1.58	10.11	.57	.00	0	186
		Lo	37.1	38.0	8.6	39.5				.57			173
	AVL S	Hi	39.5	40.7	6.9	41.2	+	.22	.36	.57	1.36	+	186
		Lo	41.7	41.4	6.7	40.8				.50			173
	AVL P	Hi	37.9	37.1	7.4	37.4	-	.36	6.20	.46	2.71	-	186
		Lo	39.3	39.3	5.7	38.9				.55			173
	AVL R	Hi	45.0	42.5	9.6	42.0	-	.12	2.19	.40	2.14	-	186
		Lo	43.2	42.6	7.9	43.1				.49			173
	D	Hi	148.1	139.7	26.8	144.0	-	.31	9.81	.35	.29	-	187
		Lo	165.4	155.9	26.1	151.7				.39			187
4	E	Hi	77.0	59.6	24.1	66.5	+	.03	.19	.09	.00	0	35
		Lo	96.1	71.4	28.7	64.3				.09			34
5	D	Hi	148.0	132.1	27.4	137.2	-	.61	.39	.26	.68	+	146
		Lo	164.1	144.0	29.3	138.9				.21			146
	E	Hi	69.6	58.6	19.4	65.3	-	.52	5.45	.18	4.86	-	146
		Lo	89.8	77.2	24.9	70.4				.29			146
	F	Hi	111.8	92.4	22.8	99.2	-	8.49	3.39	.21	.08	-	146
		Lo	130.4	110.9	30.7	104.1				.23			146

*Values meeting the 5% significance level are underscored once; those meeting the 1% level are doubly underscored.

Meaning of Symbols used in Tables 2 and 3

H, L : high-aptitude group, low-aptitude group.

M_x : initial test score mean.

M_y : retest score mean.

SD_y : retest score standard deviation.

$M_{y\ adj.}$: retest score means adjusted by covariance procedures for initial test score.

$\Delta_{cov.}$: direction of change in the covariance analysis; + indicates that the high-aptitude group had the higher adjusted mean.

F_S, F_M : F ratios obtained in testing for homogeneity of slope and homogeneity of adjusted means.

p+ : proportion of subjects who did not decrease in score from initial test to retest.

χ^2 : chi-square obtained in the nonparametric test of the same data.

Δ_{x^2} : direction of change in the nonparametric analysis; + indicates that membership in the high-aptitude group tends to be associated with greater frequency of increase in test score from initial test to retest.

N : number of cases in the subgroup.

view of the low degree of consistency from study to study, it is not unreasonable to conclude that the significant instances could indeed be false positives, attributable to chance. On these grounds it was believed appropriate to consider the evidence of all F ratios conducted on adjusted means.

Differences between adjusted means proved to be significant in 19 instances; 10 of these were with male subjects and 9 with female subjects. In the tables, significance at the 5% level is indicated by underscoring the F ratio; double underscoring indicates significance at the 1% level. For males, the following differences were significant: F_2 (1%), CPI variables Ai (1%), Ie (1%) and Re (5%), A-V-L variables T (1%), E (1%), A (1%), S (5%), and R (1%), and D_3 (1%). For females, these differences were significant: E_2 (1%), CPI variables Ai (1%) and Ie (1%), A-V-L variables T (1%), E (1%), A (1%), and P (5%), D_3 (1%), and E_5 (5%).

Eight comparisons among males and seven among females are significant at the 1% level. Examination of parallel comparisons (same study and variable) for males and females yields six instances in which the outcome was significant at this level in both groups. This state of affairs thus accounts for 12 of the 15 values of this type. These six variables are: the CPI variables Ai and Ie, the A-V-L variables T, E, and A, and D_3.

Differences significant at the 5% level number only four for the entire study. It is probably best to give them little attention since one or more could readily occur by chance, and since the actual difference in adjusted means in each case is less than one quarter of the standard deviation of the variable in question.

The direction of the outcome of each test is most easily studied by noting entries in the column headed $\Delta_{cov.}$. It will be remembered that "+" indicates a higher adjusted mean score for the high-aptitude group, and therefore more relative gain in score on the non-intellectual variable for more apt subjects. Two observations may be recorded now. First, comparing signs in parallel instances for males and females, 17 out of the 20 exhibit like signs. The exceptions are: the A-V-L variable S, E_4, and D_5. For the latter two variables chance can reasonably be involved since none of the tests approached significance.

Second, it appears that the direction of the difference is related to the general tendency for the score on the non-intellectual variable to increase or decrease from initial test to retest. To form a rough index, we may sum the initial means for the two aptitude groups and do likewise for the retest means. If the question is then raised as to the number of instances in which a "general" increase in score over time is coupled with the occurrence of more relative gain

(as evidenced by a "+" sign in the $\Delta_{cov.}$ column) for the high-aptitude group and in which a "general" decrease in score is associated with less relative gain for the high-aptitude group, the answer is: in 33 out of the possible 40 instances in the study as a whole. The seven exceptions are: the CPI variable Sc for both males and females, the A-V-L variables T, E, and S for males, E_4 for females, and D_5 for males. By inspection, about half of the variables show a substantial change from initial test to retest, others do not. Of the exceptions, only the last two are characterized by substantial change over time.

Change in Non-intellectual Function as Related to Level of Aptitude: Nonparametric Analysis

In Table 2 and Table 3, the column headed p+ presents the proportion of subjects in the indicated group who did not decrease in score from initial test to retest. The value then represents those subjects whose scores rose over time plus the relatively small number who did not change. In adjacent columns are the chi-square values resulting from the test of significance of the differences between p+ values for high-aptitude and low-aptitude groups, and for convenience, indication (in the column headed $\Delta_x 2$) of the direction of difference between each pair of proportions. A plus sign is used to note that the high-aptitude group had the higher p+ value.

It is clear that this approach gives a different picture. No chi-square reaches significance at the 1% level, and only

in four instances are there values significant at the 5% level: the A-V-L variables T and R for males, and the CPI variable Sy and E_5 for females. In view of the level of significance, the small number of comparisons meeting it, and the 40 opportunities for significance to occur, the question of false positives (errors of the first kind) rises in importance.

Comparison of Results by the Two Approaches

Three of the four variables yielding significant chi-squares also show a significant difference by the parametric approach (E_5 for females is the exception). However, since approximately half of the variables showed significance under parametric treatment, we would expect two of the four to be significant by parametric evaluation even if the two kinds of outcomes were unrelated.

Comparison of the two approaches yields two further points of interest. First, in numerous instances variables revealing substantial and significant differences under the covariance analysis nevertheless produced chi-square values of negligible magnitude. Second, attention is invited to a comparison of the direction of outcome by the two approaches. On the logic of the analyses, one would expect that if one group had a higher adjusted mean score, that same group would tend to have a higher proportion of subjects who either raised their score or did not change from test to retest. However,

comparison of signs in the columns $\Delta_{cov.}$ and Δ_{x^2} shows that in only ~~18~~ 21 out of the ~~35~~ 34 cases like signs are found. The ~~five~~ six cases in the columns headed Δ_{x^2} wherein "0" is the entry reduce the number of like sign comparisons from 40 to ~~35~~ 34. This seems particularly noteworthy when it is remembered that the two tests being compared were performed on the same samples.

DISCUSSION

Parametric vs. Nonparametric Approach

Clearly, the first issue which must be considered is the discrepancy in outcome between the covariance analysis and the chi-square test of change. The two techniques are both approaches to the same general experimental question--namely, is there differential change for young adults of different intellectual level in score on non-intellectual variables over a period of time? It is not unreasonable to expect that there would be considerable correspondence of outcome even if the null hypothesis were true in all instances, since the two analyses were applied to the same samples. One might anticipate that random sampling fluctuations which move the observed values away from expectation under the null hypothesis would have some tendency to affect both procedures in a similar direction. In fact, however, we find that in only four out of a possible 40 instances does the chi-square test yield significance, and then only at the 5% level, whereas the covariance procedure produces 19 significant values, of which 15 reach the 1% significance level. Further, the

direction of outcome, regardless of significance, is the same in only 21 out of the 34 pairs of tests wherein such a comparison can be made. It is, of course, reasonable to find that fewer significances result by the nonparametric approach because of the superior power of the parametric procedure when the assumptions of the latter are reasonably met, but the close-to-chance agreement on direction of outcome seems another matter.

Computational errors can in all probability be ruled out. The original computations under both approaches were done by electronic data-processing methods. The authors obtained a print-out of the data contained in the I.B.M. cards and, selecting several instances where there appeared to be particularly wide discrepancies between the two techniques, redid the calculations by desk calculator. Idential results were obtained.

It does not seem reasonable to assume that non-normal shape of some distributions involved is a factor which could adequately account for the discrepant results. First, results of other studies cited earlier have indicated that many of the distributions are reasonably symmetrical. Second, sample size is generally large enough so that the inherent robustness of the variance analysis is enhanced. Finally, inspection of Table 2 and Table 3 suggests no important problem with regard to heterogeneity of variance.

It is believed that explanation must be sought in the difference in meaning of the two approaches. The parametric

analog of the chi-square analysis is, of course, the test of significance of difference between mean "gain" scores for the high- and low-aptitude groups. In the design of the present study, it was considered that covariance analysis of adjusted retest means was preferable to an analysis of the difference between mean gain scores. The covariance approach to the problem of change corrects final means for initial level of performance with due consideration for the degree of correlation between initial and final scores, whereas the difference method assumes, in effect, that the correlation between initial and final scores is unity. In fact, correlation between initial and final score ranged approximately from .4 to .7. Looking at it in another way, one may view the comparison of gains in our problem as being analogous to the correlation between aptitude and gain. On the other hand, the appropriate analog of the covariance approach would be part correlation, where aptitude and retest score are correlated, but with the influence of initial score on final score ruled out. The gain score is not independent of the initial score, but with the covariance technique, the adjusted retest score is independent of the initial score. Thus covariance gives results independent of the initial score, whereas the nonparametric technique gives results which are not independent of the initial score.

It appears that different results obtain first, because the nonparametric procedure offers considerably less precision,

in the statistical sense, and second, because it answers a question which differs somewhat from that to which the covariance analysis is addressed. On the logic of the study and in view of the probable robustness of the parametric procedure, we judge that the evidence of the covariance analysis should be given major attention. Some additional support for this stand comes from the observation that there is a degree of coherence within the findings obtained by this procedure.

Covariance Analysis: Male vs. Female

It will be recalled that of the 15 (out of 40) instances yielding an F significant at the 1% level, only three represent significance attained by one sex group but not by the counterpart group of the opposite sex. All of the six parallel comparisons in which the outcome is significant for both sexes show the same direction of difference for males as for females. In the three instances where significance was not shared by both sex groups, the direction of difference was nevertheless the same in both groups. Those factors which produce differential change among high- and low-aptitude groups apparently tend to be common to both sexes. Further evidence for this is supplied by the finding that in 17 out of the 20 parallel studies for males and females, the direction of outcome was the same across sex.

Covariance Analysis: Factors Involved in Differential Change

A striking finding was that the direction of difference (in comparison of high- and low-aptitude groups) is related to the direction of change in score on the non-intellectual variable over time. It will be recalled that in 33 out of 40 possible instances, an over-all increase in score was coupled with evidence of greater gain for the high-aptitude group, and an over-all decrease in score was coupled with greater relative decrease for the same group. In other words, if score on the variable rose over time, then the bright group tended to have the higher adjusted mean; the rise is more pronounced among this group. If score on the variable decreased over time, then the bright group had the more pronounced decrease, as evidenced by their lower adjusted mean. If this analysis is reduced to a consideration of the 15 instances in which a difference between aptitude groups was found to be significant at the 1% level, it will be found that in 13 cases this same relationship prevails. In the remaining two (A-V-L variables T and E for males), the general shift in level of scoring over time is minimal.

The first point to be considered is the relation of this finding to the question of a possible scale problem, outlined earlier. In the variables used in this study, the possibility of a scale problem arose in considering the occasional occurrence of positively skewed distributions.

It was felt in view of the evidence that brighter individuals tend, in general, to have somewhat lower scores on these scales, and since this level of scoring might be low enough that there could be little "room on the scale" for them to score still lower, that a five-point reduction in score for such a person could be in actuality representative of a greater reduction than a numerically equal reduction for a person whose initial score was higher. If the null hypothesis posed in this study were true, and if this line of reasoning were correct, then in view of the tendency for brighter individuals to have somewhat lower initial scores on this type of scale, we would actually expect that when scores were generally reduced, the greater nominal reduction would be evidenced by the less apt subjects. However, examination of Table 2 and Table 3 shows 24 instances in which score decreased generally from test to retest. In 21 of these, the high-aptitude group exhibited the lower adjusted mean, evidencing the greater reduction. We therefore suggest that if there is a scale problem, and if it could properly be removed, the effect of so doing would be to increase the magnitude of the differences reported here. In short, it seems reasonable to argue that the effects observed through covariance analysis are genuine, and that, if anything, they underestimate the differences between individuals of different levels of aptitude. This line of argument, of

course, supports the earlier decision to give major attention to the outcome of the parametric analysis.

In view of this decision, it is instructive to indicate something about the meaning of the differences in the adjusted means for the 40 comparisons reported.

There seems to be general agreement among psychologists that lower D, E, or F scale scores indicate more "psychologically positive" behavior than do higher D, E, or F scale scores. For these variables, the aptitude group in each comparison with the lowest adjusted M_y score was designated as the group with the most "psychologically positive" behavior.

Either explicit or implicit in the numerous validity studies reported by Gough (1957) for the CPI scales is the notion that higher Sy, Sc, Ai, Ie, or Re scale scores indicate more "psychologically positive" behavior than do lower scores on these scales. For the CPI variables, the aptitude group in each comparison with the highest adjusted M_y score was designated as the group with the most "psychologically positive" behavior.

It is difficult to determine which scales of the A-V-L if high or low indicate "psychologically positive" behavior. There does seem to be agreement among research psychologists that higher scores on the A-V-L Theoretical (T) and Aesthetic (A) scales are more "valued" in samples of bright and well-educated subjects than are lower scores on these two A-V-L

scales. This value judgment is found expressed in the work of MacKinnon[1] and his associates studying the characteristics of groups of creative architects, mathematicians, research scientists and writers. It is also found implicit in the work of McConnell[2] and his associates who are studying the personality development of college students at a number of colleges and universities. This value judgment is shared by the writers of this report, too. Therefore, for the T and A scales of the A-V-L, the aptitude group with the highest adjusted M_y score in each comparison was designated as the group with the most "psychologically positive" behavior. No decision was made for the E, S, P, or R scales of the A-V-L.

Table 4 is a summary table of the covariance results wherein columns 1 and 3 indicate which aptitude group in each of the 40 comparisons had the highest adjusted M_y score, and columns 2 and 4 indicate which aptitude groups had the most "psychologically positive" adjusted M_y score. Attention is called to the fact that, in Table 4, 32 of the 40 comparisons have a designation of most "psychologically positive" score; 16 each for males and females.

It will be noted in Table 4 that of the 16 comparisons for high- vs. low-aptitude male groups, seven were statistically

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[1]Director, Institute of Personality Assessment and Research, University of California, Berkeley.

[2]Director, Center for the Study of Higher Education, University of California, Berkeley.

Table 4

Summary of Covariance Analyses for Males and Females

		Males		Females	
		1.	2.	3.	4.
Study	Variable	Apt. Grp. with Highest M_y adj.	Apt. Grp. with most "Psychol. Positive" M_y adj.	Apt. Grp. with Highest M_y adj.	Apt. Grp. with most "Psychol. Positive" M_y adj.
1	E	Lo	Hi	Lo	Hi
	D	Lo	Hi	Lo	Hi
2	E	Lo	Hi	Lo**	Hi
	F	Lo**	Hi	Lo	Hi
	CPI Sy	Hi	Hi	Hi	Hi
	CPI Sc	Lo	Lo	Lo	Lo
	CPI Ai	Hi**	Hi	Hi**	Hi
	CPI Ie	Hi**	Hi	Hi**	Hi
	CPI Re	Hi*	Hi	Hi	Hi
	AVL T	Hi**	Hi	Hi**	Hi
3	AVL E	Lo**	?	Lo**	?
	AVL A	Hi**	Hi	Hi**	Hi
	AVL S	Lo*	?	Hi	?
	AVL P	Lo	?	Lo*	?
	AVL R	Lo**	?	Lo	?
	D	Lo**	Hi	Lo**	Hi
4	E	Lo	Hi	Hi	Lo
	D	Hi	Lo	Lo	Hi
5	E	Lo	Hi	Lo*	Hi
	F	Lo	Hi	Lo	Hi

** sig. beyond .01 level

* sig. beyond .05 level

significant and all seven favored the high-aptitude male groups. Fourteen of the 16 comparisons favored the high-aptitude male groups. That is, high-aptitude male groups had substantially more "psychologically positive" non-intellectual scale scores at the end of two or four years than did the low-aptitude group males. These results strongly support the proposition that the trend in the development of non-intellectual characteristics for initially brighter-than-average males is similar to that of the development of intellectual characteristics for brighter-than-average subjects.

For the 16 comparisons of high-aptitude female groups compared with low-aptitude female groups (reported in Table 4), seven were statistically significant and all seven favored the high-aptitude female groups. Fourteen of these 16 comparisons favored the high-aptitude female groups. The same type of interpretation made for males can also be made for females. High-aptitude female groups had more "psychologically positive" non-intellectual scale mean scores at the end of two or four years than did the low-aptitude female groups. Again, the trend in non-intellectual development is similar to that of intellectual development for initially brighter-than-average subjects.

The generality of these findings is strengthened by noting the similarity of results for males and females. Of the 32 comparisons where the authors felt it possible to

designate psychologically desirable development, 14 were statistically significant and all 14 favored the high-aptitude groups. Twenty-eight of the 32 comparisons favored the high-aptitude groups, and 14 of 16 pairs of same-variable comparisons for the two sex groups yielded similarity.

It seems that high-aptitude groups changed in non-intellectual characteristics more in a more "psychologically positive" direction than did low-aptitude groups, and thus, differential personality change did occur over time for young adults who differed markedly in measured aptitude.

For studies of the effect of a collegiate experience upon student personality development wherein measures similar to those used in this study have been employed, it seems quite probable that the reports of positive findings are, in fact, reports of personality development of brighter-than-average young adults who were at the time of study enrolled in college.

SUMMARY AND CONCLUSIONS

Summary

All investigators of the effects of college attendance upon student personality have reported measurable effects of a generally desired sort (e.g., reduction in prejudice).

Local studies have demonstrated that similar personality changes occurred in young adults with no college attendance, some college attendance, and with the maximum amount of

college attendance possible in two-year and four-year periods.

In light of the empirical facts that college or college-bound subjects are brighter than average, and that intellectual changes continue well into adulthood for subjects who were initially brighter than average, a series of studies was undertaken to determine if the trend in non-intellectual development was similar to that of intellectual development for initially brighter-than-average subjects. If so, it was felt that this might account in large part for the positive findings reported in the "college impact or effects" research.

Existing data from five separate longitudinal studies were utilized to determine whether or not non-intellectual changes in young adults occurred differentially for high- compared with low-academic-aptitude groups. Three of the former studies were for a two-year test and retest time period, and two were for a four-year test and retest time period.

Comparisons of non-intellectual changes between high- and low-aptitude groups of males and for high- and low-aptitude groups of females were conducted over a two-year period utilizing the following measures:

Study 1: The Ethnocentrism Scale (E_1)

Study 2: The Dogmatism Scale (D_2), the Ethnocentrism Scale (E_2), and an Authoritarianism Scale (F_2)

Study 3: Five scales from the California Psychological Inventory: Sociability (Sy), Self Control (Sc),

Achievement via Independence (Ai), Intellectual Efficiency (Ie), and Responsibility (Re), the six scales of the Study of Values (A-V-L): Theoretical (T), Economic (E), Aesthetic (A), Social (S), Political (P), and Religious (R), and the Dogmatism Scale (D_3).

The following measures were utilized for the four-year time period:

Study 4: The Ethnocentrism Scale (E_4)

Study 5: The Dogmatism Scale (D_5), the Ethnocentrism Scale (E_5), and an Authoritarianism Scale (F_5).

In all, this resulted in 40 possible comparisons of non-intellectual changes over time for high- vs. low-aptitude groups (5 studies with a total of 20 variables x 2 sex groups).

Two types of statistical analyses were made for the 40 possible comparisons. Retest score means were adjusted by covariance procedures for initial test score, and F ratios obtained in testing for homogeneity of adjusted means. In addition, because of the possibility of the existence of a scale problem, the proportions of subjects in each pair of comparison groups who did not decrease in score from initial test to retest were obtained, and chi-square values were determined for the differences between proportions.

Of the 20 F ratios obtained for high- vs. low-aptitude male groups, ten were statistically significant (eight at the 1% level and two at the 5% level). The high-aptitude male groups had significantly higher adjusted retest means on the Ai, Ie, and Re scales of the CPI, and the T and A scales of the A-V-L. The low-aptitude male groups had significantly higher adjusted retest means on the F_2 scale, the E, S, and R scales of the A-V-L, and the D_3 scale.

Of the 20 F ratios obtained for high- vs. low-aptitude female groups, nine were statistically significant (seven at the 1% level and two at the 5% level). The high-aptitude female groups had significantly higher adjusted retest means on the Ai and Ie scales of the CPI, and the T and A scales of the A-V-L. The low-aptitude female groups had significantly higher adjusted retest means on the E_2 scale, the E and P scales of the A-V-L, the D_3 scale, and the E_5 scale.

Of the 20 chi-square values obtained for high- vs. low-aptitude male groups, two were statistically significant at the 5% level. A significantly greater proportion of high-aptitude males increased in A-V-L T scale score from initial test to retest, and a significantly greater proportion of low-aptitude males increased in A-V-L R scale score from initial test to retest.

Of the 20 chi-square values obtained for high- vs. low-aptitude female groups, two were statistically significant

at the 5% level. A significantly greater proportion of low-aptitude females increased in CPI Sy scale score and E_5 scale score from initial test to retest.

For several reasons, the decision was made to focus major attention on the covariance results, and an illustrative summary table was prepared to highlight the discussion of these results. It had been found that in 33 of 40 possible instances, an over-all increase in score over time was coupled with evidence of greater increase for the high-aptitude groups, or an over-all decrease in score over time was coupled with greater relative decrease for the high-aptitude groups. The summary table then not only included a designation of which aptitude groups (high or low) had the highest adjusted means at the end of two or four years, but also which aptitude groups (high or low) had the most "psychologically positive" adjusted mean scores at the end of two or four years. The judgments as to which of a pair of adjusted means in any comparison was most "psychologically positive" were made in the light of statements by test authors and of the assumptions of research psychologists studying highly creative and well-educated persons. It was assumed that the lower of the two adjusted means on either the D, E, or F scales for any high- vs. low-aptitude group comparison was the most "psychologically positive" mean score. It was also assumed that the higher of the two adjusted means on the CPI

scales Sy, Sc, Ai, Ie, or Re and on the A-V-L T and A scales for any high- vs. low-aptitude group comparison was the most "psychologically positive" mean score. No decision was made for the E, S, P, or R scales of the A-V-L adjusted means as to which, when high, was "psychologically positive."

The aptitude group in any comparison having the most "psychologically positive" adjusted mean could be designated in 32 of the 40 comparisons made. Twenty-eight of these 32 favored the high-aptitude groups.

Conclusions

1. The parametric and nonparametric approaches to the basic problem of this study yielded different results. This appeared to be because: (a) they are answering somewhat different questions, and (b) the nonparametric technique is less sensitive.

2. The nonparametric analysis was undertaken because of a possible scale problem. On the internal evidence of the parametric approach, it appears likely that the existence of a scale problem would, if corrected, enhance rather than reduce the present positive findings.

3. There is substantial evidence to suggest that there are differences between more and less apt young adults in the relative degree of change in non-intellectual test scores over time. This evidence supports the idea that there is a substantial trend for young adults of higher aptitude to

exhibit more non-intellectual change over time and in the direction of the trend of college students in general.

4. There is strong reason to believe that non-intellectual changes which occur over time among young adults are generally of a more "psychologically positive" nature as defined by values of our culture or of the sub-culture of educated persons.

5. There is strong evidence that high-aptitude groups of young adults have substantially more "psychologically positive" non-intellectual development over time than do low-aptitude groups of young adults.

6. There is strong evidence that non-intellectual development is similar in its trend to that of intellectual development for initially brighter-than-average young adults.

7. The several results pertaining to non-intellectual development observed in this study appear to be similar for males and females.

8. The results observed pertaining to non-intellectual development appear to be somewhat general in regard to different samples of young adults and different kinds of non-intellectual measures.

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